

Claims

1. A method for stimulating an immune response in a subject, comprising:
administering to a subject exposed to an antigen an effective amount for inducing a
5 synergistic antigen specific immune response of an immunopotentiating cytokine and an
immunostimulatory CpG oligonucleotide having a sequence including at least the following
formula:



wherein the oligonucleotide includes at least 8 nucleotides wherein C and G are unmethylated
10 and wherein X_1 and X_2 are nucleotides.

2. The method of claim 1, wherein the cytokine is selected from the group consisting
of GM-CSF, IL-3, IL-5, IL-12, and interferon- γ .

15 3. The method of claim 1, wherein the immunopotentiating cytokine is an antigen-
cytokine fusion protein.

4. The method of claim 3, wherein the antigen-cytokine fusion protein is an antigen-
GM-CSF fusion protein.

20 5. The method of claim 1, wherein the antigen is a selected from the group consisting
of a tumor antigen, a microbial antigen, and an allergen.

6. The method of claim 5, wherein the antigen is a tumor antigen.

25 7. The method of claim 1, wherein the antigen is administered to the subject in
conjunction with the immunostimulatory CpG oligonucleotide and the immunopotentiating
cytokine.

30 8. The method of claim 1, wherein the subject is passively exposed to the antigen.

9. The method of claim 1, wherein the subject has a neoplastic disorder.

10. The method of claim 1, wherein the subject has a viral infection.

11. A composition, comprising:

an effective amount for synergistically activating a dendritic cell of an
immunostimulatory CpG oligonucleotide having a sequence including at least the following
formula:



wherein the oligonucleotide includes at least 8 nucleotides wherein C and G are unmethylated
and wherein X_1 and X_2 are nucleotides; and

a cytokine selected from the group consisting of GM-CSF, IL-4, $TNF\alpha$, Flt3 ligand,
and IL-3.

11. The composition of claim 10, wherein the cytokine is GM-CSF.

12. The composition of claim 10, further comprising an antigen.

13. The composition of claim 12, wherein the antigen is selected from the group
consisting of a cancer antigen, a microbial antigen, and an allergen.

14. A method for activating a dendritic cell, comprising:

contacting a dendritic cell exposed to an antigen with an effective amount for
synergistically activating a dendritic cell of an immunopotentiating cytokine and an
immunostimulatory CpG oligonucleotide having a sequence including at least the following
formula:

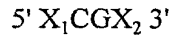


wherein the oligonucleotide includes at least 8 nucleotides wherein C and G are unmethylated
and wherein X_1 and X_2 are nucleotides.

15. The method of claim 14, wherein the cytokine is selected from the group
consisting of GM-CSF, IL-3, IL-5, IL-12, and interferon- γ .

16. The method of claim 14, wherein the antigen is a tumor antigen.

17. A method for treating a subject having a neoplastic disorder, comprising:
administering to the tumor of a subject having a neoplastic disorder an
immunopotentiating cytokine and an immunostimulatory CpG oligonucleotide having a
sequence including at least the following formula:

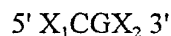


wherein the oligonucleotide includes at least 8 nucleotides wherein C and G are unmethylated
and wherein X₁ and X₂ are nucleotides, in an amount effective for synergistically increasing
survival time of the subject with respect to a subject administered the immunostimulatory
CpG oligonucleotide or the immunopotentiating cytokine alone.

18. The method of claim 17, wherein the tumor is selected from the group consisting
of a tumor of the brain, lung, ovary, breast, prostate, colon, skin, and blood.

19. The method of claim 17, wherein the immunostimulatory CpG oligonucleotide
and the immunopotentiating cytokine are injected directly into the tumor.

20. A contraceptive method, comprising:
administering to a subject an antigen, an immunopotentiating cytokine and an
immunostimulatory CpG oligonucleotide having a sequence including at least the following
formula:



wherein the oligonucleotide includes at least 8 nucleotides wherein C and G are unmethylated
and wherein X₁ and X₂ are nucleotides, wherein the antigen is an antigen selected from the
group consisting of a gonadal cell antigen and an antigen from a cytokine or hormone required
for the maintenance of a gonadal cell.